DENTAL MATERIAL

BACKGROUND OF THE INVENTION

1. Field of the invention

The present invention relates to a dental material. More particularly, the present invention relates to a composite dental material which is useful as an artificial tooth, an inlay, an onlay, a crown, a crown bridge and the like.

2. Description of the prior art

A dental material is generally required to satisfy various requirements such as sound mechanical strength and machinability, a low cost, an excellent aesthetic merit, absence of biological detrimentality and a good biological affinity. Various dental materials including resins, composite materials formed by dispersing an inorganic substance in a resin, ceramic materials, amalgams, and alloys of precious and base metals have been developed are now practically applied.

Various resins for dental purposes comprising methacrylate copolymers mainly consisting of methylmethacrylate have been developed and are in use as dental resins. These resins, being excellent in aesthetic merit, color fastness and impact resistance, are low in mechanical strength such as wear resistance and bending strength. The occlusion force during mastication of food, varying between different persons, is believed to be 78 kg on the average, and this occlusion force causes a huge stress on the tip of teeth. For these reasons, a resin as used as a dental material is defective in that is suffers from a considerable wear resulting from mastication over a long period of time, and deformation is easily caused by occlusion.

With a view to overcoming the defects of resins as described above, a composite resin made by mixing and dispersing an inorganic substance in a methacrylate-based copolymer resin has been developed. This material is advantageous in that it has a satisfactory aesthetic merit necessary for the foreteeth, and has an improved mechanical strength over a material made from a resin alone even in the molar segment required to have a mechanical strength sufficient to withstand occlusion. In order to improve physical properties of the composite resin such as mechanical strength and bending strength, and thus to achieve physical properties closer to those of natural teeth, it is necessary to uniformly disperse an inorganic substance throughout the resin, and to improve the filling ratio. The filling ratio can be improved with a resin having a large particle size. When such a resin is attached in the oral cavity as an artificial tooth, an inlay, an onlay, a crown or a crown bridge, however, the composite resin exhibits a rough surface, resulting in unavailability of a smooth and glossy surface, thus leaving a feeling of incompatibility in terms of touch with the palate. Furthermore, when the inorganic substance peels off the resin surface as a result of use for a long time and deposits accumulate at this portion, it is colored and this further reduces aesthetic merit. In the case of a composite resin having a small particle size, in contrast, as compared with those of a large particle size, the total surface area of the inorganic substance for the same volume increases, and along with the increase in viscosity upon dispersion of the inorganic substance in the resin, improvement of the filling ratio is limited to a certain level. At the same time, difficulties are encountered in handling and operability in manufacturing artificial teeth or forming or cutting clinically into an inlay, an onlay, a crown or a crown bridge. When using it in the form of ultra-fine powder, furthermore, weak electric charge of the particle surfaces and Van der Waars force cause easy cohesion of fine particles, making it difficult to obtain a uniform dispersion in the resin. Because coherent particles contain voids, there are difficulties in this case also in manufacturing artificial teeth or forming or cutting clinically into an inlay, an onlay, a crown or a crown bridge. Cohesion leads to a rough surface, leaving a feeling of incompatibility in touch with the palate. Trials are being made to solve the foregoing problems by combining different particle sizes, i.e., coarse and fine particles, charged in the resin so as to achieve presence of fine particles in the gaps between coarse particles. In terms of obtaining a uniform dispersion and a high filling ratio, a satisfactory result has not as yet been achieved. Under these circumstances, a composite resin having satisfactory mechanical strength, color fastness and coloring resistance for a long time has not as yet been obtained.

A porcelain material, which is a ceramic dental material used for long, is high in wear resistance and bending strength, excellent in aesthetic merit, color fastness and coloring resistance, free from biological detrimentality or irritation in the oral cavity, and is a stable dental material exhibiting no change in material quality even in a long-term use. As compared with a resin or a composite resin, however, it is defective in that it is high in cost, poor in elasticity, low in impact resistance because of brittleness, and tends to suffer cracking and fracture. In manufacturing a porcelain material, there occurs a considerable shrinkage caused by firing, thus making it difficult to accurately sinter into a prescribed shape. It is the usual practice to use a porcelain material after polishing and form-correction. Thermal stress during correction polishing causes microcracks which grow larger through repetition of daily occlusion pressure during mastication of food and impact caused by chewing hard food, thus resulting in fatigue breakage, or under an excessive occlusion load, in breakage. When a porcelain material is used as a ceramic tooth in a denture, mechanical holding means such as a pin or a retaining hole is provided in the ceramic tooth to achieve an integral connection of the porcelain material and the resin, because of a very low adhesion between the ceramic tooth and the resin serving as a plate or a support. Such holding means tends however to be subjected to stress concentration, and a defective attachment causes cracks in the surrounding resin or breakage of the ceramic tooth after attachment in the oral cavity. The ceramic tooth may also tend to come off the denture base of resin. For these reasons, manufacture of a satisfactory denture using a ceramic tooth requires skill and a high cost.

An amalgam and metallic materials including precious and base metals satisfying various requirements for physical properties are often kept at a distance for their poor aesthetic merit since they have metallic gloss, and some are eluted and exhibit toxicity, thus giving the risk of exerting an adverse effect on human health.

When any of these dental materials is used for dental therapy in the form of an artificial tooth, an inlay, an onlay, a crown or a crown bridge, it is necessary to use various machines and tools and conduct processing at an accuracy of at least 50 to 100 g m. Skill of a high degree is required until a person becomes capable of manually accomplish processing at such a high accuracy, and it is not easy to maintain accuracy at this level. In addition, it is difficult to conduct such process at a high efficiency, and this forms a cause of a high cost. For the purpose of solving the difficulty of keeping skilled operators, accomplishing processing rapidly at a high accuracy, and reducing the cost, it is now tried to integrally carry out all operations ranging from input of dental processing data, processing, design and to cutting and finish-processing of the dental material by the use of a CAD/CAM system, and there is an increasing demand for developing a dental material more suitable for the CAD/CAM system.

SUMMARY OF THE INVENTION

The present invention was created as a result of extensive studies carried out to develop a dental material capable of